CLAIMS

1. A method of determining a heat treatment to apply to a structural member, so as to modify the deformation behaviour of the structural member when subjected to an applied stress, the method comprising:-

simulating the deformation behaviour of the structural member when subjected to the applied stress;

simulating the effect of at least one heat treatment upon the at least part of the structural member so as to determine a heat treatment to apply to the at least part of the structural member, to produce the modified deformation behaviour.

2. A method according to claim 1, wherein the simulation of the deformation is performed using a numerical modelling method.

3. A method according to claim 1 or claim 2, wherein the simulation of the heat treatment is performed using a numerical modelling method.

4. A method according to claim 2 or claim 3, wherein the numerical modelling comprises a finite elements method.

5. A method according to any of the preceding claims, wherein the heat treatment is simulated with a localised heat source.

6. A method according to any of the preceding claims, wherein the heat treatment is simulated with a moveable heat source.

7. A method according to any of the preceding claims, wherein the heat treatment is determined such that the simulated temperature generated in the structural member is less than the melting temperature for the material.

8. A method according to any of the preceding claims, wherein each heat treatment is defined by a parameter and wherein a number of heat treatments are simulated by varying the parameter.

9. A method according to claim 8, wherein the heat treatment parameter describes one of the travel speed of

the heat source, the heat input, the heat intensity distribution or the maximum temperature of the heat source.

10. A method according to any of the preceding claims, wherein the heat treatment is determined automatically.

11. A method according to any of the preceding claims, wherein the method further comprises selecting one or more regions forming part of the structural member in accordance with the simulated deformation.

12. A method according to claim 11, wherein each region is selected in accordance with a deformation property.

13. A method according to claim 12, wherein the deformation property is selected from a ductility, stress, strain, elongation or fracture property.

14. A method according to claim 12 or claim 13 wherein each region is selected at a location in the structural member in accordance with a threshold in the deformation property.

15. A method according to any of claims 12 to 14, further comprising assigning a target threshold to the deformation property for each region.

16. A method according to claim 15, further comprising repeatedly:-

simulating the deformation of the structural member having the assigned deformation property threshold in each region;

comparing the simulated deformation with a desired behaviour; and,

assigning a new target threshold and/or new region(s);

until the desired deformation behaviour is simulated.

17. A method according to claim 15 or claim 16, wherein the heat treatment is determined so as to produce a deformation behaviour meeting the target threshold in each region.

18. A method according to claim 17 when dependent upon claim 16, wherein the deformation behaviour produced is the desired deformation behaviour.

19. A method according to any of claims 11 to 18, wherein the selection of each region is performed automatically.

20. A method according to any of the preceding claims, further comprising simulating the deformation behaviour of the structural member in the heat treated condition.

21. A method according to claim 20 when dependent upon claim 11, further comprising repeating the method to identify further regions for subsequent heat treatment.

22. A method according to any of the preceding claims, further comprising applying the determined heat treatment(s) to a structural member workpiece.

23. A method according to claim 22, wherein the determined heat treatment(s) are applied using a localised controllable heat source.

24. A method according to claim 23, wherein the heat treatment(s) are applied using a laser or induction coils.

25. A method according to any of claims 22 to 24, further comprising monitoring a received structural member workpiece so as to generate monitored data, wherein the simulation of the deformation behaviour is performed using the monitored data.

26. A method according to claim 25, wherein the heat treatment for each region is selected from a group of predetermined heat treatments for the structural member.

27. A method according to any of the preceding claims, wherein the structural member includes at least two substructural members welded together.

28. A method according to any of the preceding claims, wherein the structural member is a vehicle impact member.

29. A computer program comprising computer program code means adapted to perform the method according to any of the preceding claims.

30. A computer program according to claim 29, embodied on a computer readable medium.

31. An impact protection member comprising at least one localised heat treated region, each of the at least one region being generated by the application of a heat treatment to a localised region of the impact protection member, wherein each heat treated region is arranged to

modify the deformation behaviour of the impact protection member when the member is subjected to an applied stress.

32. An impact protection member according to claim 31, wherein each region is generated by the application of a heat treatment to a surface of the member, said surface being defined by first and second axes, wherein each heat treated region is localised with respect to the said surface such that each region extends along only part of the surface with respect to each of the first and second axes.

33. An impact protection member according to claim 31 or 32, wherein the heat treated region is localised such that, during application of the heat treatment, thermal gradients are formed in the member along each of the first and second axes defining the surface throughout the duration of the heat treatment.

34. An impact protection member according to any of claims 31 to 33, wherein each of the dimensions of each region are small with respect to the corresponding dimensions of the surface.

35. An impact protection member according to any of claims 31 to 34, wherein each region is positioned upon the surface such that it is substantially enclosed within the boundary of the surface.

36. An impact protection member according to any of claims 31 to 35, wherein the impact protection member comprises a plurality of discrete localised heat treated regions.

37. An impact protection member according to claim 36, wherein at least one heat treated region is provided upon each of a plurality of surfaces of the impact protection member.

38. An impact protection member according to any of claims 31 to 37, wherein the impact protection member is a vehicle crash box.

39. An impact protection member according to any of claims 31 to 38, wherein for each region, the thickness of the member material in a direction normal to the surface and

the corresponding heat treatment are arranged such that a substantially similar heat treatment is provided at each point through the thickness of the material in the direction normal to the surface.

40. An impact protection member according to any of claims 31 to 39, fabricated from an aluminium alloy.

41. An impact protection member according to any of claims 31 to 40, wherein the modified deformation behaviour comprises an increased energy absorption during deformation or a reduction in the applied stress at which the impact protection member initially deforms plastically.

42. An impact protection member according to any of claims 31 to 41, wherein each heat treatment is determined according to a method of any of claims 1 to 28.